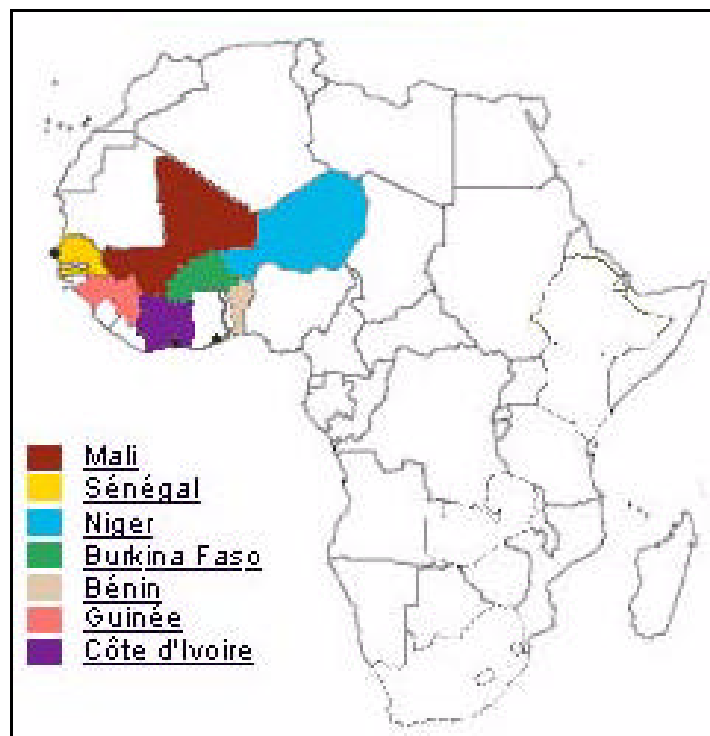


UNEP / UNESCO / UNCHS / ECA

**URBAN POLLUTION OF SURFICIAL AND GROUNDWATER
AQUIFERS VULNERABILITY IN AFRICA**

Benin, Guinea, Niger, Mali, Côte d'Ivoire, Senegal, Burkina Faso



**PROJECTS PROGRESS REVIEW MEETING
03 – 05 SEPTEMBER 2001
EVALUATION OF THE PROJECT**

SEPTEMBER 2001

By Loïc GIORGI
Project Consultant

UNEP / UNESCO / UNCHS/ECA
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PROJECTS PROGRESS REVIEW MEETING
ABDIJAN, COTE D'IVOIRE
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**URBAN POLLUTION OF SURFICIAL AND GROUNDWATER
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Benin, Guinea, Niger, Mali, Côte d'Ivoire, Senegal, Burkina Faso

*SURFICIAL AQUIFER AND URBAN POLLUTION IN AFRICA
Benin, Guinea, Niger, Mali, Côte d'Ivoire, Senegal, Burkina Faso*

**PROJECT REVIEW MEETING
ABIDJAN – COTE D'IVOIRE
03 – 05 SEPTEMBER 2001**

1. BACKGROUND

After a period of eight (8) months of activities scheduled by the participants at the Bamako, Mali, meeting held in December 2000, every country was committed to present scientific and technical results in order to bring out the achievements of the works relating to the 'URBAN POLLUTION OF SURFICIAL AND GROUNDWATER AQUIFERS VULNERABILITY IN AFRICA' project.

The operations progress and the scientific and technical results presented in this report support and confirm the information of the documents provided with and made available in June 2001 by every country involved in the project (see L. Giorgi's first report).

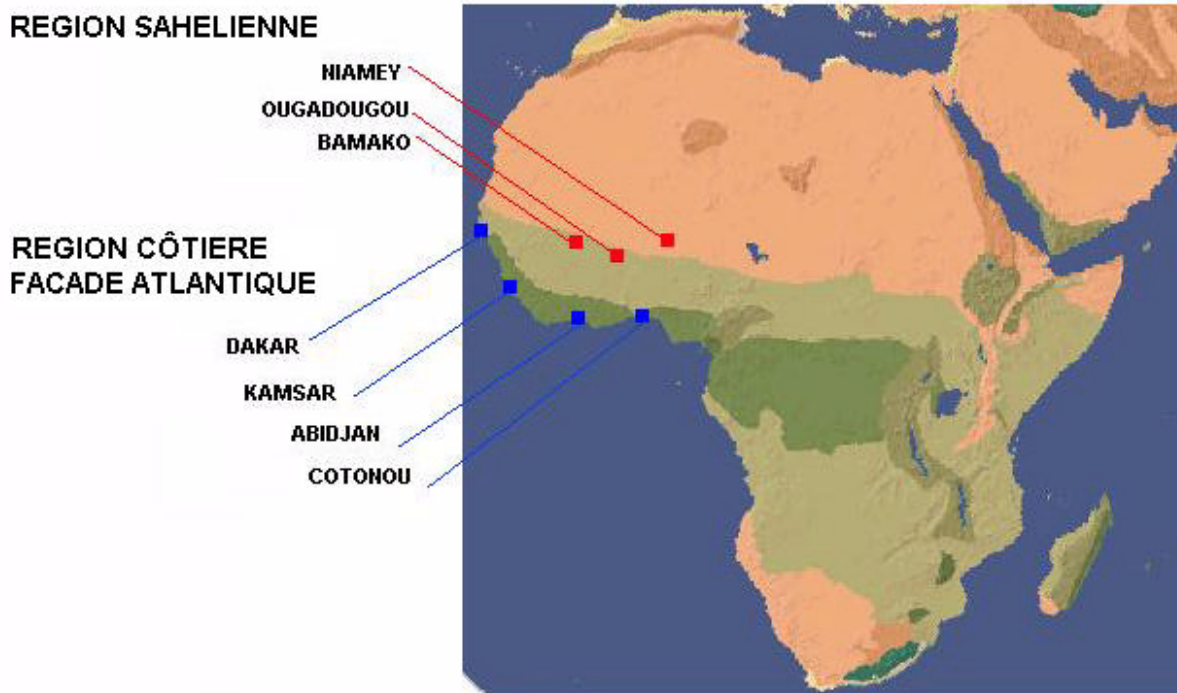
2. PROJECT'S PROGRESS

The presentation of the project's progress will still necessitated the consideration of the geographic and climatic context of the countries involved to facilitate a comprehensive position.

It was therefore decided that the countries involved in the project (fig. No. 1) be addressed according to the following groupings :

- Coastal countries and cities/of the Atlantic shoreline/of Western Africa :-
Dakar/Senegal – Kamsar/Guinea - Abidjan/Côte d'Ivoire - Cotonou/Benin
- Sahelian Countries of Western Africa :-
Bamako/Mali – Ougadougou/Burkina Faso – Niamey/Niger

Figure 1 – CONTEXT OF COUNTRIES INVOLVED

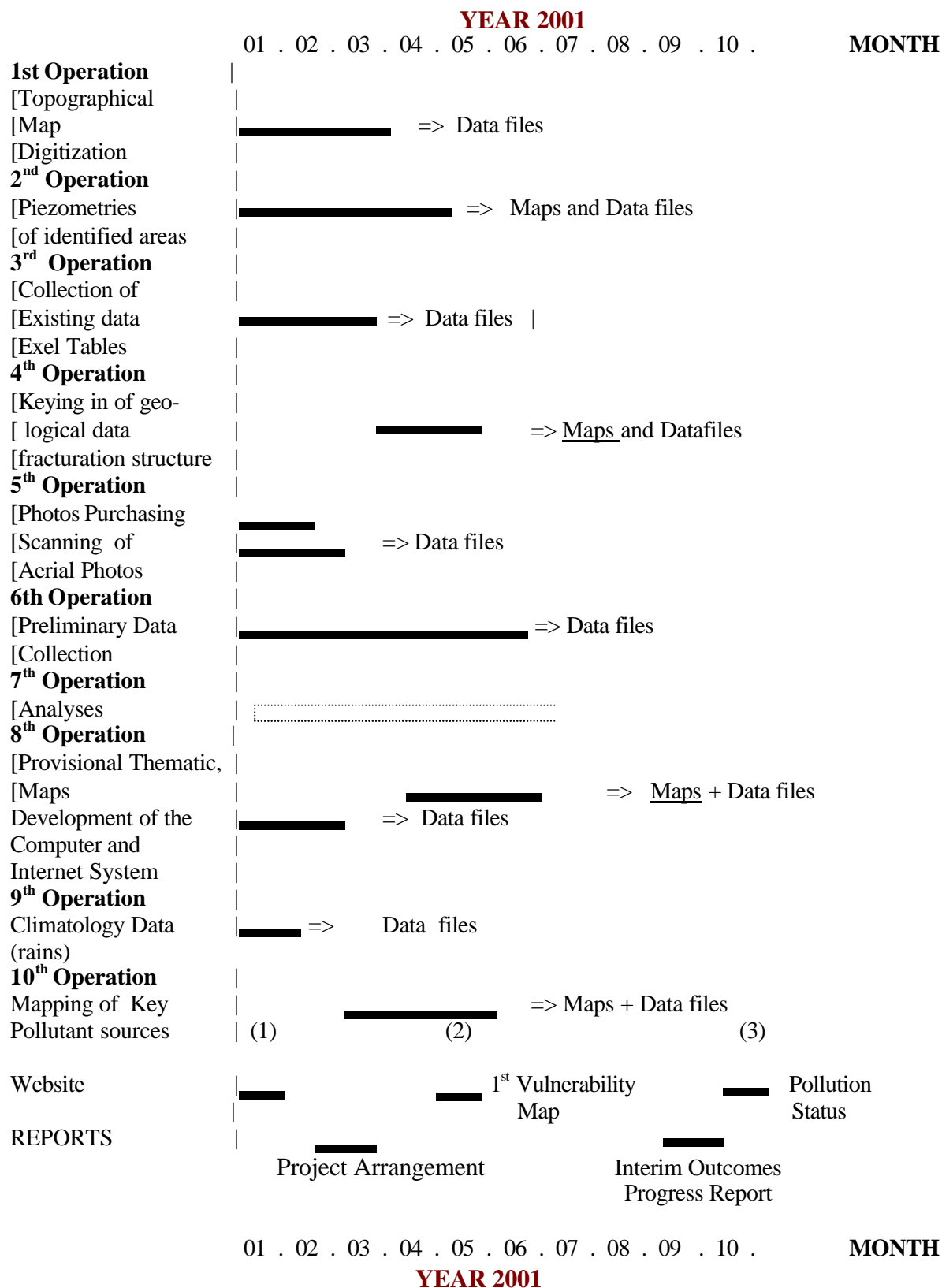


The report will focus on the timetable approved (table 2.1) by the participating countries during the launching meeting held in Bamako in December 2000 as well as the tabulated country reports in order to appreciate the progress achieved so far (L. Giorgi, Consultant, June 2001). The project work progress was presented under the following tables (table 2.2 and table 2.2 continued and table 2.3 and table 2.3 continued). The tables focus on the 10 technical operations approved in December 2000 and which were supposed to be successfully achieved by all the countries after the first eight (8) months of activities.

The scientific and technical outcomes were summarized so that they can be disseminated as widely as possible. They are presented by cities and regions. They focus on the documents released by the participating countries at the beginning of the meeting.

2.1. SUMMARY OF THE TIMETABLE APPROVED BY THE BAMAKO MEETING, DECEMBER 2000

TABLE 2.1.



2.2. COUNTRY PRESENTATIONS OF THE OPERATIONS PROGRESS

The 7 involved countries presented their achievements and data files (1 document and data files).

Among the Seven (7) presentations released :

- Four (4) Countries (Cote d'Ivoire, Niger, Benin, Burkina Faso) have presented valuable and qualitatively varied information data consistent with the hydrogeological and urban contexts.
- One (1) Country (Senegal) presented valuable but incomplete information data following the damaging, of the diskettes on the way to Abidjan. Having previously appreciated the information data, the Consultant requested to communicate them to all the participants as soon as possible.
- One (1) Country (Mali) presented a field work without the other crucial operations scheduled in December 2000.
- One (1) Country (Guinea) presented no information data, excluding many maps almost irrelevant to the project's objectives.

Among the seven teams considered :

- Five (5) teams achieved over 90% of the planned operations. The 10% of operations which were not performed are attributable to the current thematic uncertainties prevailing in some objectives and to some delays in the collection and computerization of some data. The pollution data are not reliable, which resulted in a delay in the development of Vulnerability maps.
- One (1) team (Mali) achieved less than 30% of the planned operations. The 10% of operations which were not performed were attributable to the individual conflicts and disagreements prevailing within the Mali team.
- One team (Guinea) achieved less than 10% of the planned operations, roughly less than what was expected in June 2001 (cf. L. Giorgi, Consultant June 2001).

Ninety per cent of the operations which were not performed confirm that the Guinea team were not able to appreciate the objectives determined by the participants to the Bamako meeting. It should be noted that the city of Kamsar is not in line with the project's objectives.

TABLE 2.2.

WESTERN AFRICA / URBAN COASTAL ZONE / ATLANTIC FRONT					
	1ST Operation OP 01 Topographical map Digitization	2nd Operation OP 02 Piezometry of Identified areas	3rd Operation OP 03 Collection of existing data	4th Operation OP 04 Keying in of geological data, fracturation, structure	5th Operation OP 05 Aerial photos purchasing – Photos Scanning
SENEGAL Dakar	Work achieved operation implemented Database available	Work achieved Database collected Database available	Work achieved Operation implemented Data available	Work achieved Database collected Database available	Work to be supervised
GUINEA Kamsar	Work on stand-by Database to be collected Database not available	Work to get started Operation to get supervised	Work to be improved Operation to be improved	Work to be modelled Operation to be improved	Database to be collected Database not available
COTE D'IVOIRE Abidjan	Work achieved Operation implemented Database available	Work achieved Operation Implemented Database available	Work achieved Operation implemented Data available	Work achieved Operation Implemented Database available	Work achieved Database collected Database available
BENIN Cotonou	Work achieved Operation implemented Database available	Work achieved Operation implemented Database available	Work achieved Operation implemented Data available	Work achieved Operation implemented Database available	Database to be collected Database not available

TABLE 2.2. (continued)

WESTERN AFRICA / URBAN COASTAL ZONE / ATLANTIC FRONT					
	6th Operation OP 06 Preliminary Data Collection	7th Operation OP 07 Analysis developed under the project	8th Operation OP 08 Provisional thematic maps	9th Operation OP 09 Climatology Data	10th Operation OP 10 Mapping of Pollutant
SENEGAL Dakar	Work Achieved Operation Implemented Database available	Work in good progress Database collection in process Interim Database available	Work in good progress Database collection in process Interim Database available	Work achieved Database collected Database available	Work to be supervised
GUINEE Kamsar	Work to be supervised	Work to be monitored	Work to be performed	Work to be monitored and modelled	Work to be performed
COTE D'IVOIRE Abidjan	Work Achieved Operation Implemented Database available	Work in good progress Database in process Database available	Work in good progress Database in process Database available	Work achieved Operation implemented Database available	Work achieved Operation implemented Database available
BENIN Cotonou	Work achieved Operation Implemented Database available	Work achieved Operation implemented Database available	Work outlined Operation Implemented Database available	Work achieved Operation implemented Database available	Work outlined Operation implemented Database available

TABLE 2.3.

WESTERN AFRICA / URBAN SAHELIAN ZONE					
	1st Operation OP 01 Topographical Map Digitization	2nd Operation OP 02 Piezometry of identified areas	3rd Operation OP 03 Collection of Existing Data	4th Operation OP 04 Keying in of geological data, fracturation, structure	5th Operation OP 05 Aerial photos purchasing Photos Scanning
MALI Bamako	Work on stand by Database to be collected Database not available	Work achieved Database collected Database available	Work achieved Operation implemented but to be finalized Data available	Work achieved Database collected but to be improved Database available	Work to be performed Database not available
BURKINA FASO Ougadougou	Work achieved Database collected Database available	Work achieved Database collected Database available	Work achieved Operation performed Data Available	Work achieved Operation implemented but to be performed Data available	Work to be performed Database not available
NIGER Niamey	Work achieved Operation implemented Database available	Work achieved Operation implemented Database available	Work achieved Operation implemented Data available	Work achieved Operation implemented Database available	Work to be implemented Operation implemented Database available

TABLE 2.3. (continued)

WESTERN AFRICA / URBAN SAHELIAN ZONE					
	6th Operation OP 06 Preliminary Data Collection	7th Operation OP 07 Data/Analyses processed under the project	8th Operation OP 08 Provisional Thematic Maps	9th Operation OP 09 Climatology Data	10th Operation OP 10 Mapping of pollutant Sources
MALI Bamako	Work achieved Operation implemented Database available	Work to be performed	Work to be performed	Work not achieved	Work to be performed
BURKINA FASO Ougadougou	Work in good progress Database in the process of collection Provisional Database available	Work in good progress Database in the process of collection Provisional Database available	Work in good progress Database in the process of collection Provisional Database available	Work achieved Operation implemented Database available	Work to be performed
NIGER Niamey	Work achieved Operation implemented Database available	Work in good progress Database in the process of collection Provisional Database available	Work in good progress Database in the process of collection Provisional Database available	Work achieved Operation implemented Database available	Work to be performed

3. SCIENTIFIC AND TECHNICAL OUTCOMES FRAMEWORK OF THE REGIONAL MONITORING SYSTEM OF AQUIFER POLLUTION

3.1. URBAN COASTAL ZONE / ATLANTIC SHORELINE

**SENEGAL, DAKAR
COTE D'IVOIRE, ABIDJAN
BENIN, COTONOU**

- a. Aquifer systems were sampled and analysed for hydrological and chemical parameters.
- b. Pollutant sources were identified and though the cartographic data require some improvement in terms of details, the correlation and trend guidelines are to be effectively targeted.
- c. Precipitation records were established.
- d. Data necessary to assess the development and trends, though separately processed and saved in various files was available. It is now up to the decision makers of these African Countries to decide on the vulnerability and degree of pollution of these urban areas (bulletins).

For the city of **Dakar**, it is possible to address the following stages of the project (c.f. hereunder) and focus on the warning system (including bulletins) consisting of four samples of boreholes of drinking water affected by a surficial aquifer already polluted.

For the city of Abidjan, the above mentioned remarks are also relevant. The only additional element is the establishment of a sanitation plant in one of the sectors of the city which partially reduces the downstream pollution. This facility should bring out one of the positive aspects of the urbanization, subject to an urban development which cares about the discharge of wastewater.

The data relating to the city of Cotonou are now available. It is possible to address the following stages of the project. We are now focusing on a comprehensive warning system (including the bulletins) located in the four samples of boreholes affected by the surficial aquifer already polluted. The bulletins should be communicated to the Health division for the urban sector of the city and to the division of the main network of drinking water (pumping area warning system).

GUINEE (KAMSAR)

No development nor presentation was performed by the delegate from Guinea during this meeting. As he was forced to give the reasons of his failure, the delegate from Guinea clearly agreed that the team will maintain their participation in the project on the condition that they are given the opportunity to present another site (city) and bring out within 15 days (the 3rd week of September 2001) the data necessary for the various operations. In fact, the city of Kamsar has never met the objectives of the project.

The Consultant therefore cancelled his site visit to Guinea as he could not undertake any mission without basic information and without a minimum work programme (The Consultant to date has not received from the Guinea team any communication on technical matters). He is therefore 90% convinced that Guinea will not take part in the project any more by the end of September 2001.

3.2. SAHELIAN URBAN ZONE

NIGER (NIAMEY)

- a. Aquifer systems were sampled and analysed for hydrological and chemical parameters.
- b. Pollutant sources were identified and though the cartographic details and chemical components need to be improved, the correlation and trend guidelines targeted.
- c. Precipitation records were established. These data shall be completed with the Niger river regime.
- d. Data necessary to assess the development and trends, though separately processed and saved in various files, were available. It is now possible to try to formulate the advisable criteria to inform the decision makers of African Countries about the vulnerability and degree of pollution of these urban areas (in bulletins).

For the City of Niamey, it is also possible to address the following stages of the project. The operations to be implemented could and should be focused on the pumping facilities (boreholes and/or wells) located perpendicularly to the Niger river for the early warning system sites. A regular follow-up should help to clarify the seasonal fluctuations eventually modified by the urban pollution. Then, the guidelines of the early warning system (to the pollution plan) to be tested in the short and middle term would be formulated. First and foremost, this system (including the bulletins) will be designed for the health sector. It can be communicated to the managers of the drinking water supplying systems getting water from the river in so far as the system includes the sampling stations.

BURKINA FASO (OUGADOUGOU)

- a. Identified aquifer systems (fracture, intermittent and heterogeneous aquifers) were presented by the representative of the team.
- b. Established and identified pollutant sources were not yet inserted in their comprehensive hydrogeological context. This is due to an aquifer system based on a fracture network that results in a very heterogeneous aquifer. The design of the early warning systems of Ouagadougou will be slightly different and more localized.
- c. Precipitation records relating to the urban zone under review were not clearly specified. For Ouagadougou, the data on the filling-up of the reservoirs of drinking water are not processed to date. But can this operation be easily carried out ?

For the city of **Ougadougou**, it is possible to address the following operations, but through a methodology that focuses on the existing aquifer system. A significant development should be brought out after an observation and measuring period long enough to allow a better understanding of the problem of the relevance of the outcomes which is critical in the area.

MALI (BAMAKO)

- a. Identified aquifer systems were clearly presented
- b. Established and identified pollutant sources were inserted in their hydrological context, but on the basis of the previous data.

- c. Field operations of measuring were carried out but none was analytically achieved (chemical and bacteriological outcomes).
- d. Precipitation records relating to the Mali urban zone under review was not clearly specified. The flow regime of the Niger river at Bamako was not specified.
- e. The existing data that we know were not actually adequately reported and processed by the team to facilitate any anticipated formulation and definition of recent developments and trends. Except the conductivities which are keyed in the database, there are practically very few data which have been collected in the database in process.

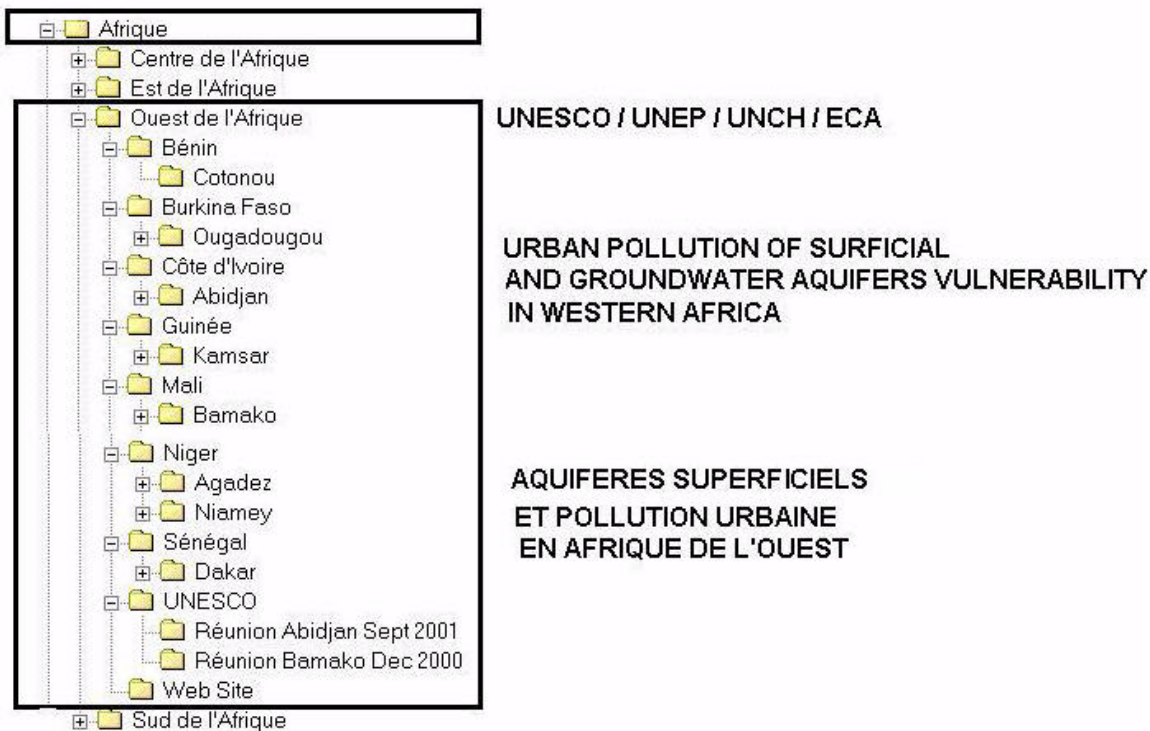
For the city of Bamako, was not possible to address the following operations without processing the data requested in the first operations of the project (Map digitization, Data updating, ...)

Following the explanations afforded by the head of the Mali team, the initiators of the project and the Consultant agreed that the collaboration of all the government departments involved in the project is fundamental. Failing this, the participation of Mali will be cancelled by the end of October.

4. PROJECT DATABASE

Each country submitted the electronic versions (diskettes, disk-zips, CD-roms) of its data. All the data were recorded in the filing system (fig. 2 below). The format was made at the meeting of June 2001 and submitted to each participant – in CD-Rom copy. The size of the database, by September 2001 in 245 Megabytes (terms + consultant). Now, the database must be streamlined, validated and cleared of duplications and all other useless provisional files through a continuing rise. This database must be at the disposal of most of the donors in case of need.

4.1. FORMAT OF THE DATABASE - Figure n° 2



It was noted that the datafile contents which were designed for a simple and homogeneous database are extremely user friendly. After seeking the views of all those present, A detailed presentation of the data tables under the Excel format which should be maintained were detailed. The formats of the datafiles for the mapping which should be processed under Arc View format and transferred under dxf format were also presented.

The participants were apparently inclined to use the english version of the Arc View Software for the cartographic datafiles. It will be used as a model for the cartographic datafiles. The datafiles will be transferred under dxt standard format for any further software application.

The french version of DESIGNER which is not frequently used was nevertheless very much appreciated by the team of Cote d'Ivoire and the team of Benin later on due to its user-friendliness and flexibility. The opportunities of the software which is a geographic information system of easy access have been showed off.

The purchasing of the following softwares were approved :

- ARC VIEW – Version 3.2 University/Multiple Licence
- DESIGNER Version No. 10 – 2001

5. COMMUNICATION AND DISSEMINATION MEANS – INTERNET / WEBSITE

The project website which is jointly seriesed by the Senegal team and Consulting E-business Samba G. Ndieye (Senegal) and under the supervision of Abdoul Aziz TANDIA was streamlined by UNEP's computer scientists in Nairobi, Kenya in June and July 2001.

The original version and the revised version were both presented by the delegate from Senegal. But it was fundamentally necessary to optimize this tool by using more efficient connections provided by more efficient suppliers. If connection shortcomings and some delays in displaying datafiles oblige us to be occasionally more cautious in developing (involving each country) and using such a dissemination tool, we shall imperiously focus on such a momentous work.

Technical discussions among the members of the team, the coordinators who were present, the consultant and Brian Morris, the independent observer from *British Geological Survey* (BGS) have facilitated the identification of the more adequate options for the moment. Two major options are identified which underscore the project's outcomes : the implementing tool of the detailed project and the dissemination of the outcomes of the project (database).

The second option in view of the existing technical constraints (data transmission, response times via Internet, difficult and slow connections...) has been approved (however it shall incorporate the actual database) with a solution for the second option. The implementing tool option is not dismissed and will be maintained with the use of PDF formats to be called up from the webpage.

Therefore , the website shall be developped under its UNEP revised version but including the thematic maps, the data (the database) and more attractive photos. Shall also be keyed in the links to more technical documents and reports (veery voluminous files) which will be processed in under PDF format to avoid using up too much space on the site and to maintain the objectives.

6. CONSULTANT'S STREAMLINED TECHNICAL INTERVENTIONS

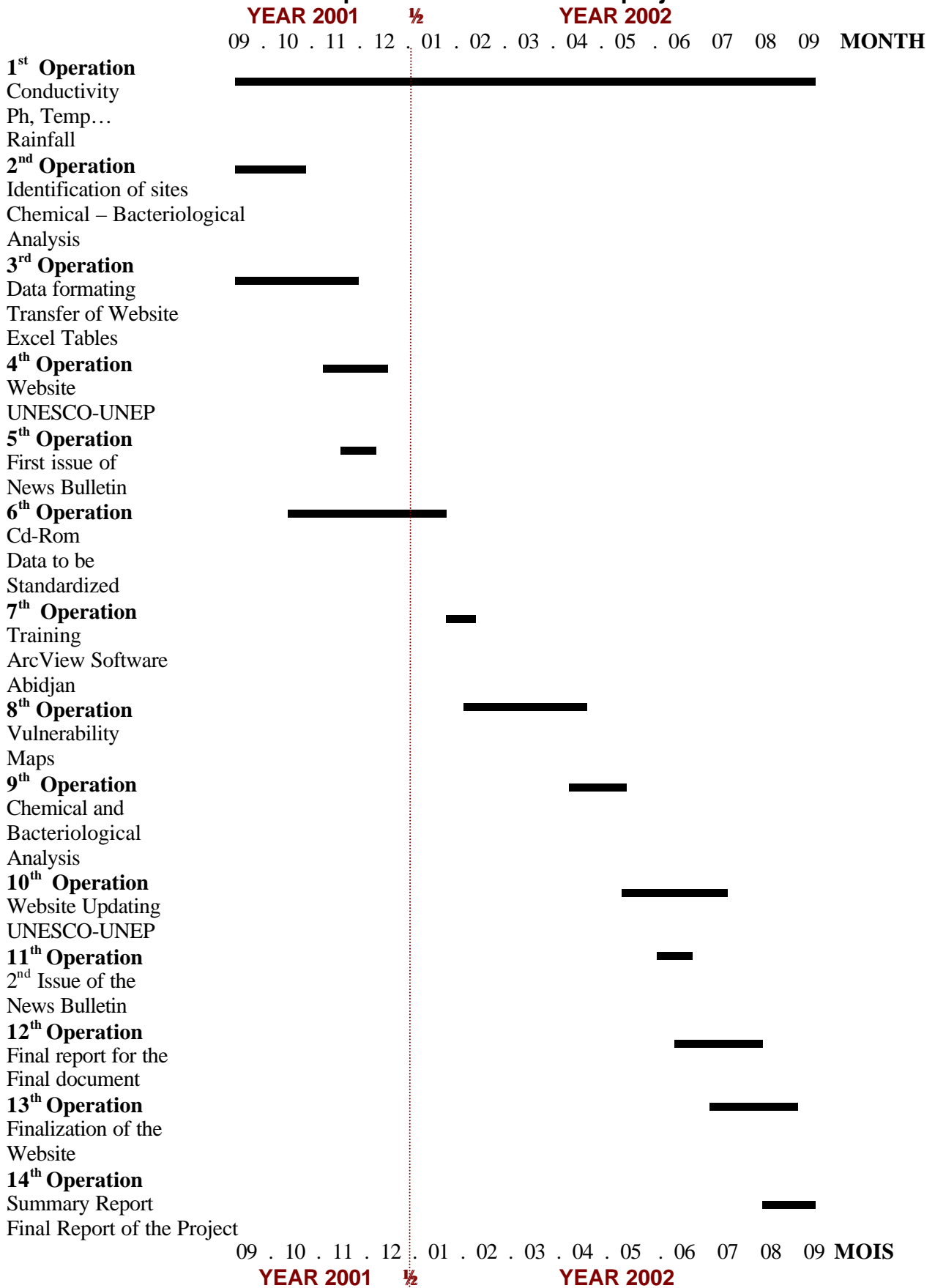
6.1. Technical guidelines of the Warning System – News Bulletin

It has been agreed that four sites (boreholes, well or surface water) should be identified and that a sampling should be taken from each site at the end of any rainy or dry season. All the samples will undergo physico-chemical and bacteriological analysis. Throughout one year 8 results at least can be obtained from the chemical and bacteriological analyses. The analysis will be positioned with the weekly follow-up of the conductivity of the pH and the weather. At the end of the project, each country shall present the 8 analysis and the weekly measurements as tabulated results including :

- 2001 dry season (practically)
- 2001 rainy season
- 2002 dry season

The decision makers of the country where the city is located will receive a news bulletin released as regularly as possible (i.e. in the short term, every month).

6.2. Identification of the next operations and end of the project

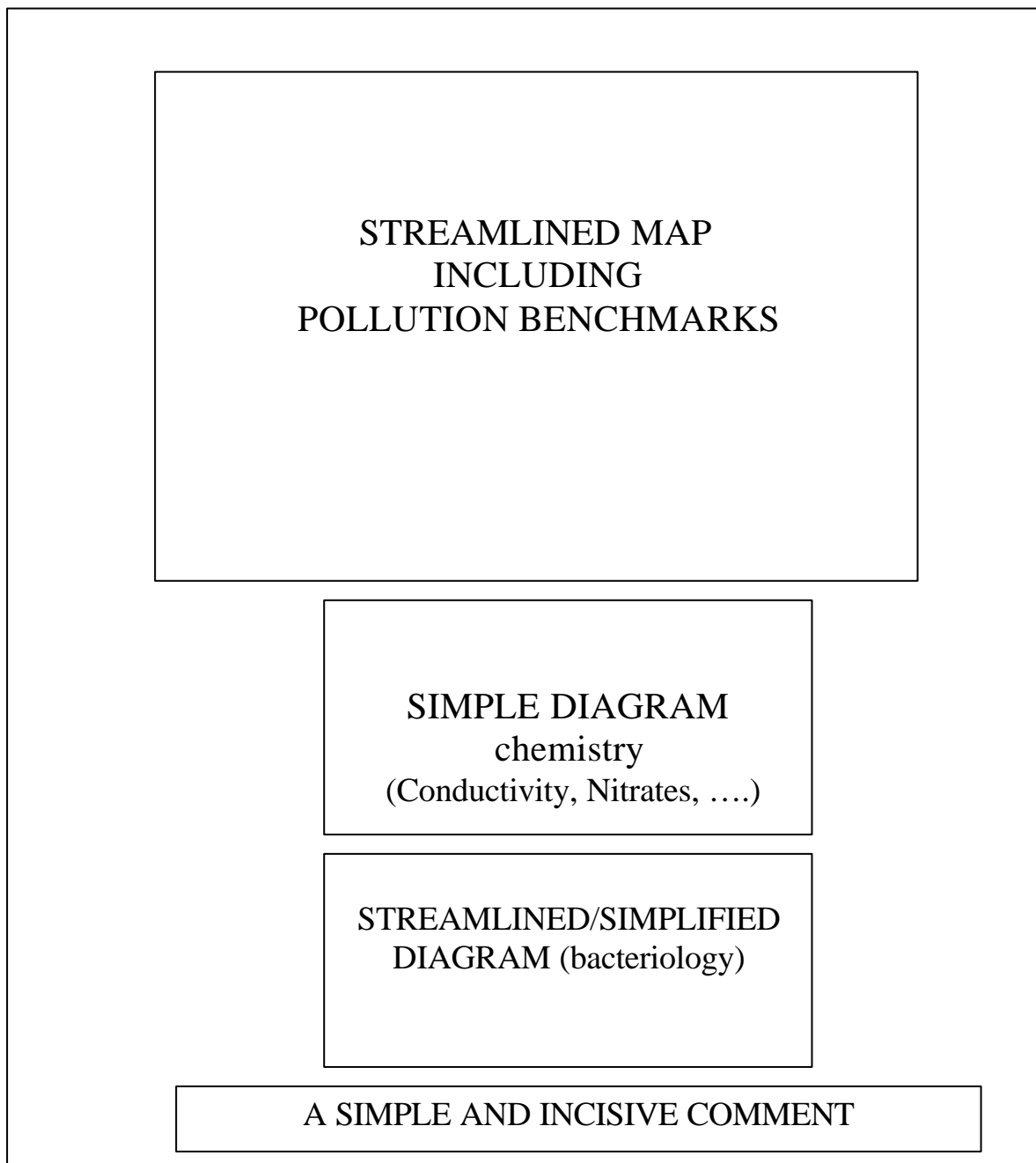


6.3. INFORMATION EXCHANGE – COLLABORATION AMONG TEAMS AND COORDINATORS

Information was not adequately shared among the teams who discovered their respective works performed by their counterparts on the day of the meeting. The coordinators of the national teams shall manage to regularly disseminate the results of their investigation and technical problems.

The preparation of the news bulletin of the warning system shall be developed through a practice of information sharing among all the stakeholders. However, the key guidelines which have been discussed during the meeting are mentioned below. This draft is open to any amendment and should be considered as a starting point of the information exchange.

FORMAT OF THE WARNING SYSTEM NEWS BULLETIN (operations 5 to 11 of the following scheme)



Training – Support in Data Processing

The countries involved were provided for months with the following softwares which are operational:

- *DESIGNER - version 2000 / complete version*
- *ARC VIEW GIS - version 3.2 / Assessment version*

(at least for the countries which have made them installed and which have been using them to process their data files).

The need for training formally expressed by many countries resulted in the following :

- Agreement that training shall absolutely be focused on the data files of the project of each city involved and that it requires a preparatory work on the datafiles.
- Saving for the training, of the balances of the project's credits following the reallocation of some funds (for further information, please contact Emmanuel NAAH, UNESCO representative and Salif DIOP, UNEP Representative).
- Identification of the dates and venue for the training session (Abidjan 4-10 February 2002 in CURAT, a facility belonging to the research team of Patria JOURDA).

Development of the curriculum of the training which is first and foremost a group training to use the project's softwares. The training session will be supervised by the Computer Scientists from CURAT, Cote d'Ivoire and the Consultant through Internet contact.

Technical and Hydrological Support

Each team will regularly communicate the outcomes (even the incomplete ones) of the approved operations to the Consultant in order to discuss whether they should be validated or not.

Support for the drafting of the final report

It is critical to standardize the reports, the final warning bulletin and the data supporting the planned strategy in order to provide data which go beyond the bounds of the participants in the project and create an important impact. It is imperative that each team disseminates as regularly as possible the work on the coordinators and the consultant of the project.

7. GUIDELINES OF A GEF PROJECT.

The development of a more ambitious project (GEF Project) relating to urban pollutions (vulnerability aspects including hot spots, warning systems, dissemination bulletins...) in the aquifers should not be addressed in terms of hydrogeological context with regard to the state of the data presently collected in the countries involved. In fact, the databases of the country taking part in the project remain the framework of the GEF project.

On the basis of the stocktakings made by the teams of the 'Urban Pollution of Surficial and Groundwater Aquifers Vulnerability in Africa' project and by its coordinators (in Benin, Guinea, Niger, Cote d'Ivoire, Senegal and Burkina Faso), the constraints which have been noted with regard to a more important GEF project are the following :

- Identification of the human resource with the capability to achieve the various technical operations in the countries selected.
NB. The computer type questionnaire suggested by the observer from the British Geological Survey will be tested for the selection of a country. The test will be implemented in Cote d'Ivoire and in Senegal.
- Extension and dissemination activities on the decision makers whom must be perspicaciously identified for a long term and efficient action.
- Knowledge of regulations, mainly the regulations taken into account and implemented.
- Identification of economic interfaces capable of inspiring a trend of new practices based on increasing pollutions in a developing urban area.

In conclusion, it was recommend that:

- The extension of the development of this project to many countries to complement the perspective of urban pollution in Africa (Western Africa, Southern Africa, Eastern Africa, Southern Africa and Indian Ocean). The involvement of these countries in the project should be based on their greater or lesser dependence on groundwater for their water supply.
- The collection of a database as starting point to the works on urban pollutions (vulnerability aspects including hot spots, warning systems, bulletins...)
- The Analysis and targeting of the planned actions to develop downstream the technical action a perspective of urban area development. We may result in a specific case for each country.

NB. UNESCO and UNEP initiators of the project (Emmanuel NAAH and Patrick M'MAYI) who were present at Abidjan meeting, the observer from the British Geological Survey (Brian MORRIS) and the technical Consultant (Loic GIORGI) met on the 6th of September 2001 after the meeting was closed to discuss and clarify some concepts of a 'medium size' project for the Africa region and the Indian Ocean.

Brian MORRIS will firstly circulate to the initiators of the project (E. NAAH, S. DIOP P. M'MAYI and to the Consultant L. Giorgi) a recommendation which shall be criticized and progressively improved until the final version which will be communicated and utilized is formulated.

8. ACTIVITIES OUTCOMES / CONCLUSION

After eight months of implementation of the activities the UNEP/UNESCO UNCH/ECA joint project on 'Urban Pollution of Surficial and Groundwater Aquifers Vulnerability in Africa' has technically and strategically located five (5) teams in the key climatic zones of Western Africa/two teams in the Sahelian region – Niamey/Niger and Ouagadougou/Burkina Faso, and three teams in the Coastal region/atlantic shoreline – Dakar/Senegal, Abidjan/Cote d'Ivoire and Cotonou/Benin.

Based on the new timetable of the identified and approved operations, the five (5) teams should be able to elaborate the vulnerability maps and the elements planned for the early warning system on the urban pollution in Western Africa, and the news bulletins.

The other two teams (one team in each climatic zone) will be closely monitored by the initiators of the project who shall make a decision for maintaining them in the project, at the latest by the end of the third week of September 2001 with regard to Guinea and at the latest by the end of October 2001 with regard to Mali.

With an asset of five (5) operational teams (Senegal, Cote d'Ivoire, Niger, Benin and Burkina Faso) at various and specific levels, it is recommended to emphasize the final aspect of the project for the dissemination of the comprehensive information (database) and the targeted aspect of the early warning (information supported by a strategy and a vision based on hydrogeological phenomena strongly destabilized by the urban development.

The extension of this strategy (to be improved and finalized) to other African regions, in order to identify the teams and sites (who unavoidably will not be operational as a whole) has been widely addressed (medium project GEF).

Loic GIORGI
Consultant.

Mauritius, the 24th of September 2001

Annexe

Note Brian Morris - Principal Hydrogeologist, British Geological Survey

COMMENTAIRES DE L'OBSERVATEUR MONSIEUR BRIAN MORRIS PRINCIPAL HYDROGEOLOGIST, BRITISH GEOLOGICAL SURVEY

i) project vision:

This is summed up in comments I have included in the GEF proposal concept about the gap between those influencing city development policy and the groundwater scientists who need to be informing policy-making decisions. Of the three reasons for the this gap (inability to see 'the big picture', sustainability linkage unrecognised and lack of data), it is the paucity of data that needs to be tackled first, and that is just what this project is designed to do. I applaud the decisions to concentrate on this area first, which is implicit in the project's terms of reference, and the capacity-building opportunities it has provided.

(ii) rate of progress:

Yet no matter how well scoped a project is, if the execution is lacking, the result will be disappointing. That can certainly not be said of this project. In the 8 months since official inauguration, 5 teams have collated key available data, set up a water level monitoring and water quality sampling network, collected and analysed samples, established early versions of databases and started producing thematic material for future GIS use. I would judge that to be a very creditable result; the details of which you will no doubt find in Mr Giorgi's review meeting report of progress.

(iii) international cooperation:

I was also struck by the high degree of cooperation shown by the individual country teams. For instance, after identifying training requirements in the area of GIS manipulation and hydrochemistry sampling and interpretation, there was rapid mutual agreement that one team strong in each field (Ivory Coast for former, Niger for latter) should undertake supportive training for the other members. Morale and genuine camaraderie are important contributors not only for the success of the present multi-country project but for the future, so that those who are often nationally unique in their technical field feel that they have colleagues in the region that understand the problems and can help provide solutions.

(iv) technical content:

As a practising hydrogeologist working in this field of urban groundwater, I was especially interested in the technical approach adopted and the balance struck between the various tasks. In this respect I was impressed not only by Mr Giorgi's evident technical competence but also by the pragmatic approach that has been adopted by the programme participants. For instance, the monitoring will combine

surveillance of simple pollution indicators, measurable either in the field or in a small water laboratory, with up-to-date use of data loggers to assess water level response to rainfall and thereby find one component of the urban recharge jigsaw puzzle.

I have comments on two topics that came up during the meeting:

(i) Non-delivery by two participant teams of data/material to timetable.

This delicate matter will no doubt be referred to in your back-to-office reports. I gained the impression that the participant team from Guinea is now too far behind to be able to catch up within the lifetime of this project, even if the will/ability were there. If the recommendation from the supervisory team were to drop Guinea from this project, I would support it. The reasons for Mali's slow progress do not appear to be the same, and if the supervisory team recommended clear notice to the institution(s) involved with a conditional (and short) timetable for compliance, I would support that too. Otherwise there is the risk that these two member teams will not only hold back progress of the project as a whole, but will also become a disproportionate drain on the time and financial resources of the project, whose budget is quite modest. Funds so liberated could be used to provide extra training for the 5 teams that have delivered.

(ii) Stakeholder education.

I may have been mistaken but I sensed a certain reluctance by country team members to start the long process of stakeholder involvement, possibly on the grounds that it is not 'technical' or 'scientific'. This is an understandable reaction, and stakeholder involvement in my limited experience (still very much learning myself!) can be frustrating. However it is quite practical to start the process gently and with modest efforts. I therefore strongly support Mr Giorgi's suggestion for each city team to issue a regular bulletin, say every 2-3 months, comprising a paragraph or two of explanatory/interpretative text in simple terms and a couple of graphs from key wells. These could be sent to the city's water utility and perhaps a couple of other key stakeholders. We have done this on one of our projects and it is not onerous once set up. It would demonstrate the start of transfer of early warning information from technical institute to policymaker.

I hope these informal impressions are helpful and wish the project and its participants every success in its second term.

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